

WHAT IS CLAIMED IS:

1. A liquid discharge head, comprising:
a discharge port to discharge a liquid;
a liquid flow path communicating with said
5 discharge port and having a bubble generating region to
let the liquid generate a bubble;
a discharge energy generating device, installed in
a substrate, to generate thermal energy to let the
liquid generate the bubble in said bubble generating
10 region; and
a plate-like movable member located in an position
opposite to said discharge energy generating device
with a distance from said discharge energy generating
device, fixed an end part of an upstream side thereof
15 in a direction of a flow of the liquid in said liquid
flow path and made the end of a downstream thereof
free, and formed on said substrate by film formation,
wherein the side part of said movable member has
no right angle or no acute angle.
20
2. A liquid discharge head, comprising:
a discharge port to discharge the liquid;
a liquid flow path communicating with said
discharge port and having a bubble generating region to
25 let the liquid generate the bubble;
a discharge energy generating device, installed in
a substrate, to generate thermal energy to let the

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liquid generate the bubble in said bubble generating region; and

a plate-like movable member located in a position opposite to said discharge energy generating device with a distance from said discharge energy generating device, fixed an end part of an upstream side thereof in a direction of a flow of a liquid in said liquid flow path and made the end of a downstream thereof free, and formed on said substrate by film formation,

wherein an edge of the side part of said movable member has a curved face.

3. A liquid discharge head, comprising:

a discharge port to discharge a liquid;

a liquid flow path communicating with said discharge port and having a bubble generating region to let the liquid generate a bubble;

a discharge energy generating device, installed in a substrate, to generate thermal energy to let the liquid generate the bubble in said bubble generating region; and

a plate-like movable member located in a position opposite to said discharge energy generating device with the distance from said discharge energy generating device, fixed an end part of an upstream side thereof in a direction of a flow of a liquid in said liquid flow path and made the end of a downstream thereof

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free, and formed on said substrate by film formation,
wherein the edge of the side part of said movable
member is chamfered.

5 4. The liquid discharge head according to claim 1
or 3, wherein said movable member is one formed by
photolithographic technique on a device substrate on
which said discharge energy generating device is
installed.

10 5. A liquid discharge head, comprising:
a discharge port to discharge the liquid;
a liquid flow path communicating with said
discharge port and having a bubble generating region to
15 let the liquid generate a bubble;

a discharge energy generating device, installed in
the substrate, to generate thermal energy to let the
liquid generate the bubble in said bubble generating
region; and

20 a plate-like movable member located in a position
opposite to said discharge energy generating device
with a distance from said discharge energy generating
device, fixed an end part of an upstream side thereof
in a direction of a flow of the liquid in said liquid
25 flow path and made the end of the downstream thereof
free, and formed on said substrate by film formation,
wherein on a surface of said substrate, a

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plurality of electrode layers, that is extended to at least a part of a region and a part around the region corresponding to a plurality of said movable member and is electrically connected to said discharge energy

5 generating device, are formed; and

in comparison with a width in a direction right-angled to the direction of a liquid flow in said liquid flow path in all of said electrode layers, the width in the direction right-angled to the direction of a liquid
10 flow in said liquid flow path and in parallel to a surface of said device substrate in said movable member becomes small.

6. The liquid discharge head according to claim
15 1, wherein a constituting material of said movable member is a ceramic.

7. The liquid discharge head according to claim
20 1, wherein a constituting material of said movable member is silicon nitride.

8. A liquid discharge apparatus comprising: a liquid discharge head according to claim 1 and actuation signal supply means for supplying an
25 actuation signal for discharge of the liquid from the liquid discharge head.

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9. A liquid discharge apparatus comprising: a liquid discharge head according to claim 1 and recording-medium carrying means for carrying a recording medium to receive the liquid discharged from the liquid discharge head.

10. The liquid discharge apparatus according to claim 8 or 9, recording through discharging ink from said liquid discharge head and attaching the ink to the recording medium.

11. A method of manufacturing a liquid discharge head, comprising:

a device substrate, a plurality of discharge energy generating devices to generate thermal energy to let the liquids generate a bubble, being provided in parallel on a surface thereof;

a plurality of liquid flow paths, in each of which each of said discharge energy generating devices is arranged, having a bubble generating region to let the liquid generate a bubble;

a plurality of discharge ports to discharge the liquid in the liquid flow path, each of the discharge ports communicating with each of said liquid flow paths;

a flow path wall member mounted on said device substrate to form said plurality of liquid flow paths;

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and

a plurality of plate-like movable members, which are mounted on said device substrate to face each of said plurality of discharge energy generating devices with an interval with respect to each said discharge energy generating devices and an end part of an upstream side in the direction of the liquid flow in said liquid flow path is fixed and a downstream end is a free end,

wherein the method, of manufacturing the liquid discharge head, comprises a post-treatment step of removing a right-angled part projecting to make a distal end right-angled in an edge part of a side part of said movable member and an acute-angled part projecting to make the distal end acute-angled in the edge after a plurality of movable members are formed on said device substrate by photolithographic technique.

12. The method of manufacturing a liquid discharge head, according to claim 11, wherein in said post-treatment step, the edge of the side part of said movable member is processed to make the edge to curved one.

13. The method of manufacturing a liquid discharge head, according to claim 11, wherein in said post-treatment step, the edge of the side part of said

movable member is processed to make the edge to chamfered one.

14. The method of manufacturing a liquid
5 discharge head, according to claim 11, wherein said post-treatment step is a step of soaking said movable member in an etching solution.

15. The method of manufacturing a liquid
10 discharge head, according to claim 11, wherein said post-treatment step is a step of processing said edge by radiating a laser light on the edge of the edge of the side part of said movable member.

15 16. A method of manufacturing a liquid discharge head, comprising:

a device substrate, a plurality of discharge
energy generating devices to generate thermal energy to
let the liquids generate the bubble, being provided in
20 parallel on a surface thereof;

a plurality of liquid flow paths, in each of which
each of said discharge energy generating devices is
arranged, having the bubble generating region to let
the liquid generate the bubble;

25 a plurality of discharge ports to discharge the liquid in the liquid flow path, each of the discharge ports communicating with each of said liquid flow paths;

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a flow path wall member mounted on said device substrate to form a plurality of said liquid flow path; and

5 a plurality of plate-like movable members, which are mounted on said device substrate to face each of said plurality of discharge energy generating devices with an interval with respect to each of said discharge energy generating devices and an end part of an upstream side in the direction of the liquid flow in
10 said liquid flow path is fixed and the downstream end is the free end;

a ceiling board, that is adhered to a face of a side opposite to said device substrate side, of a plurality of said side wall of the flow path,

15 in which on the surface of said device substrate, a plurality of electrode layers, which are extended to at least the part of the region and the part around the region corresponding to said plurality of movable members and each of which is electrically connected to
20 said discharge energy generating device, are formed, comprising the steps of:

preparing said device substrate in which said plurality of discharge energy generating devices are mounted on the surface of said device substrate and a
25 plurality of electrode layers;

forming a pattern member, corresponding to a space of said bubble generating region, on the surface of

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said device substrate;

layering a first material layer for forming said movable member to cover said pattern member;

5 layering an etching-resistant protection film, having etching-resistant property against said first material layer, on the surface of said first material layer;

10 patterning said etching-resistant protection film to make said movable member of which angle is right-angled to the direction of the liquid flow in said liquid flow path and width is small in a shape in parallel to the surface of said device substrate in said movable member;

15 layering a second material layer for forming said side wall of the flow path to cover said etching-resistant protection film patterned;

20 removing the part, corresponding to said liquid flow path, of said second material layer by etching and forming said side wall of the flow path and said liquid flow path; and

removing said pattern member after the step for forming said liquid flow path and forming said movable member.

25 17. The method of manufacturing a liquid discharge head according to claim 11, wherein silicon nitride is used as the material of said movable member.

18. The method of manufacturing a liquid
discharge head according to claim 16, wherein silicon
nitride is used as the material of said movable member,
PSG is used as the material of said pattern member, and
5 aluminum is used as the material of said etching-
resistant protection film.

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